Effect of Species, Breed and Variations in Season on the Total Reducing Capacity of Milk *

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Studies were made on the total reducing capacity (TRC) of milk from buffalo, cow and goat. The difference between different breeds of cow and buffalo was not statistically significant. The values for goat milk were comparatively less. The effect of seasons on the TRC was significant at 0.1 per cent level. The seasonal variation revealed that the highest values were in September and February and lowest in May corresponding to the availability of green fodder, indicating that products manufactured in the glut season would have a better oxidative stability.

Many factors are known to influence the composition of milk which include species, breed of cattle and season of the year. The various breeds of dairy cattle as a result of long continued segregation and inbreeding, show pronounced and characteristic differences in the composition of their milks. Armstrong[1] has observed variations in the gross composition of milk in different breeds. Overman *et al.*[2] have reported in American breeds of cows, changes in milk composition due to variations in feed, and due to seasonal changes. Several workers [3–8] have reported differences in proteins in the milk of different cattle. Nickerson [9–10] has observed significant seasonal and area differences in most of the components of milk including lactalbumin and lactoglobulin. Goat milk is used in India in considerable quantities accounting for nearly 558.8 thousand metric tonnes[11]. Prakash and Janners[12] have reviewed the composition and characterstics of goats milk. The present investigation was undertaken to study the effect of breeds and seasons on the total reducing capacity (TRC) of milks of buffalo, cow and goat.

Materials and Methods

Studies were made on three different breeds of cows i.e. red *Sindhi*, *Sahiwal* and *Tharparkar* and the *Murrah* buffaloes maintained at National Dairy Research Institute, Karnal. The goat milk samples were obtained from a nearby village. The composite samples of milk were taken from each breed of cows and buffaloes for analysis at weekly intervals, and fortnightly from *Barbari* breed of goats. The cows and buffaloes were fed mostly the fodder grown in the Institute farm and the type of fodder fed to the cattle was as follows: (a) Khariff season (May to September): Jowar (*Sorghum vulgare*), maize (*Zea mays*), bajra (*Pennisetum typoideum*), hybrid napier grass, cow peas (*Vigna catiang*). (b) Rabi season (October to April): oats (*Avena* sp), barley (*Hordeum vulgare*), barseem (*Trifolium alexandrium*), lucerne. (c) Glut season (February to April, August to October): green fodder was available in plenty. (d) Lean period (May to July, November to December): during this period animals mostly depended on silage, hay, etc.

In addition, the animals were fed the following concentrate mixture: 10 per cent each of oats, maize, and barley: 20 per cent gram; 15 per cent bran; 30 per cent peanut oil cake; 2.5 per cent mineral mixture and 2.5 per cent common salt. For the first 4 litres of milk yield, no concentrate mixture was given provided the animals got green fodder in the following manner; for every 100 kg. of body weight 9 kg. of green fodder or 6 kg of silage or 2 kg of dry fodder. This was approximately equivalent to about 40 kg of green fodder per animal per day, consisting of a mixture of legumes, hybrid napier and cereal fodders. The dry fodder normally consisted of hay. One kg of dry fodder was substituted for every 3 kg of silage or 4 kg of green fodder. However, the animals were not fed more than 2 kg of dry feed per animal per day. For additional 2 litres of milk the above concentrate mixture was given at the rate of 1 kg per animal.

The reducing substances in milk were estimated by the methods of Chapman and Mc Farlane [13] and Crowe *et al* [14]. Acid ferricyanide was reduced by sulphydryl compounds to ferrocyanide and at the same time sulphydryl compounds were oxidized to disulphide compounds. Acid ferrocyanide was reacted with ferric chloride solution to give Prussion blue which was estimated spectrophotometrically. The method adopted for estimating the reducing capacity of milk was as follows:

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To one ml of milk was added 9 ml of distilled water and 5 ml of 0.2 M phosphate buffer of pH 7.4 to get a final pH of 6.6 Five ml of one percent potassium ferricyanide was added. The contents were heated for 20 min in a water bath thermostatically controlled at 70. C and then cooled in ice water bath for 30 min. Five ml of 10 per cent trichloroacetic acid solution was added filtered through Whatman No. 40 filter paper. Five ml of fil rate was mixed with 5 ml of distilled water and 1 ml of 0.1 per cent freshly prepared ferric chloride solution. After 10 min the readings were taken in a Beckman DU Spectrophotometer against a reagent blank at 660 μm. Cysteine hydrocholoride was used as the reference standard.

Results and Discussion

The total reducing capacity of milk of different breeds of cows and *Murrah* buffaloes and the seasonal variations were studied for 12 months (from November 1964 to October 1965). The milk samples were analysed at weekly intervals throughout the year. The number of animals and their average milk yield is given in Table 1. The data showing the effect of species and breed on the sulphydryl[1] content (SH) expressed in terms of mg. cystein HCl per ml. of milk are presented in Table 2. The data on seasonal variations have been presented in Fig. 1, 2, 3 and 4.

The statistical analysis of the data revealed that there was no significant difference between breeds of cows and buffaloes in the SH content in the milk(Table3). The effect of season on the TRC of milk of the three species of animals was found to be highly significant (0.1 per cent level). The highest sulphydryl content was observed in September and February and lowest in May. From the beginning of December till the middle of February, there was a steady increase in the sulphydryl content; sulphydryls were observed to be maximum during February and March, thus clearly

TABLE 1. PARTICULARS OF DIFFERENT BREEDS OF COWS AND BUFFALOES AND THEIR AVERAGE MILK YIELD

Breed and species	No. of animals	Avetage milk yield animal/day kg.
Murrah buffaloes	40	5.5
Red *Sindhi* cows	94	7.0
Tharparkar cows	130	6.7

TABLE 2. EFFECT OF SPECIES AND BREED ON THE TOTAL REDUCING CAPACITY OF MILK

Breed and Spices	No. of samples analysed	Sulphydryl content as mg. cysteine HCl per ml. of milk		
		Min	Max	Average
Murrah Buffaloe	53	0.406	0.460	0.434
Red *Sindhi* cow	53	0.379	0.445	0.418
Sahiwal cow	53	0.379	0.450	0.422
Tharparkar cow	53	0.400	0.450	0.421
Barbari goat	20	0.238	0.348	0.307

TABLE 3. STATISTICAL EXAMINATION OF DATA BY ANALYSIS OF VARIANCE TEST

Source of variance	d.f.	S.S.	M.S.S.	F.	Significance
Between breeds	3	0.00474	0.00158	1.398	N. S.
Between seasons	3	0.04668	0.01556	3.770	**
Seasons X Breeds	9	0.00272	0.00030	1	N. S.
Error	196	0.22151	0.00113	–	
Total	211	0.27565			

**Significant at 1% level
N.S. : Not significant.

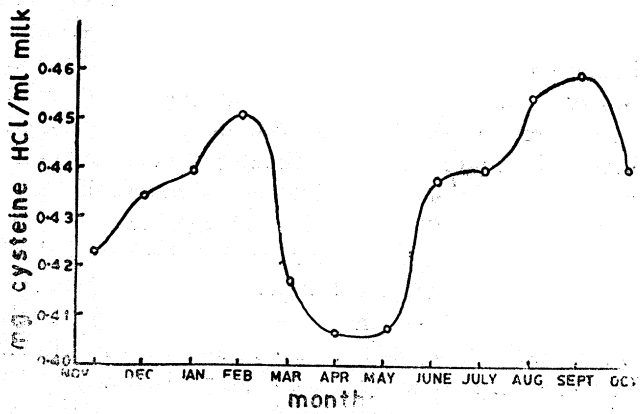

Fig. 1. Seasonal variations in the sulphydryl contents of milk from murrah buffaloes.

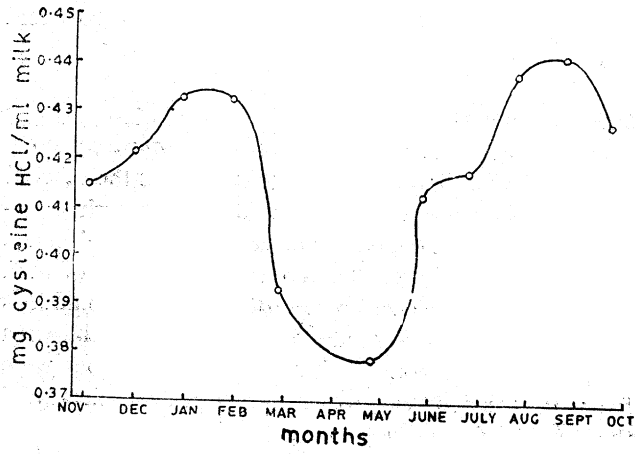

Fig. 2. Seasonal variations in the sulphyrl content of milk from red sindhi cows.

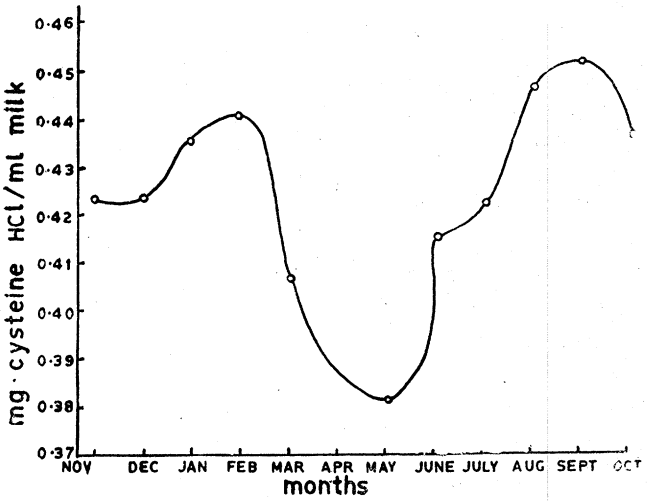

Fig 3. Seasonal variations in the sulphydryl contents of milk from sahiwal cows.

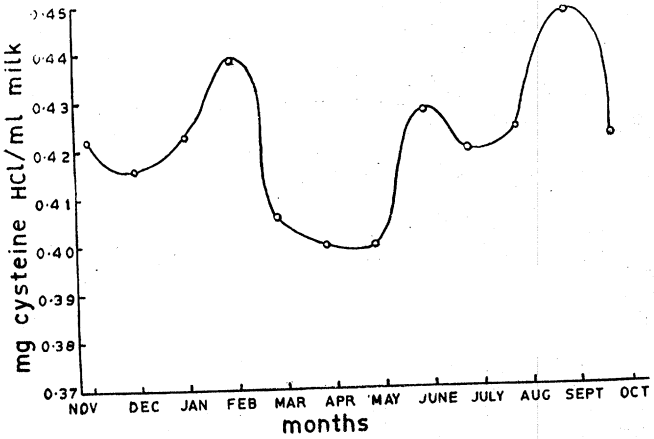

Fig. 4. Seasonal variations in the sulphydryl contents of milk from tharparkar cows

showing that the sulphydryl content varied according to the season and the availability of fodder. David [15] has reported considerable interbreed variation and has related the protein content and the sulphur content in the milk. Similarly Kiermeir and Renner[17] have reported a significant correlation between protein content and the sulphydryl content in heated milk. Literature on sulphydryls in goats milk is scarce. Ormiston and Herried[18] have reported that on processing cooked flavour was less in goats milk as compared to cows milk.

It has been reported earlier that the stability of processed products is enhanced by the presence of sulphydryl compounds. Hence it may be inferred that products manufactured during the season when more of green fodder is available (glut season) will have a better stability than products made during the lean period.

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REFERENCES

1. Armstrong, T. V., *J. Dairy Sci.*, 1959, **42**, 1.
2. Overman, O.R., Garett, C. F., Wright, K. E. and Sanmann, F. P., *III Agriculture Exp. Stn. Bull.*, 1939, 457.
3. Basu, K. P., Paul, T. M., Shroff, N. B. and Rahman, M.A., *Composition of Milk and Ghee.* I.C.A.R. Report Series No. 8, Indian Council of Agricultural Research, New Delhi.
4. Overman, O. R., Sanmann, F. P. and Wright, K. E., *III Agriculture. exp. Stn. Bull*, 1929, 325.
5. Overman, O. R., *J. Dairy Sci.*, 1945, **28**, 305.
6. Rolleri, G. D., Larson, B. L. and Touchberry, R. W., *J. Dairy Sci.*, 1956, **39**, 1683.
7. Rowland, S. J., *J. Dairy Res.*, 1938, **9**, 47.
8. Turner, C. W., *Mc. agric. exp. stn. Bull.*, 1935, 365.
9. Nickerson, T. A., *J. Dairy Sci.*, 1961, **43**, 598.
10. Nickerson, T. A., *J. Dairy Sci.*, 1961, **44**, 1257.
11. Kumar, L. S. S., Aggarwala, A. C., Arakeri, H. R., Kamath, M. G. and Moore, E. N., Roy L. D., *Agriculture in India—Animals*, Asia Publishing House, New Delhi, 1963, Vol. III, p. 39-47.
12. Parkash, S. and Jenness, R., Review Article No. 143, *Dairy Sci. Abst.*, 1968, **30**, (2), 67.
13. Chapman, R. A. and Mc Farlane, W. D., *Can. J. Res.*, 1945, **23B**, 91.
14. Crowe, L. K., Jenness, R. and Coulter, S. T., *J. Dairy Sci.*, 1948, **31**, 595.
15. Davidov R. N. and Gal Itseva V. P., *Dairy Sci. Abst.*, 1964, **26**, (4), 190.
16. White, J. C. D. and Davis, D. T., *J. Dairy Res.*, 1958, **25**, 236.
17. Kiermeir, F. and Rewner, E., *Milch Wissenchaft*, 1965, **20** (3), 138.
18. Oriston, B. E. and Herricad, E. O., *J. Dairy Sci.*, 1965, **48**, 501.